Claims

1. A method of determining the nature of a submarine or subterranean reservoir having an electromagnetic characteristic and whose approximate geometry and location are known, which comprises:

applying a time varying electromagnetic field to the strata containing the reservoir; detecting the electromagnetic wave field response; and analysing the effects on the characteristics of the detected field that have been caused by the reservoir, thereby determining the content of the reservoir, based on the analysis, wherein the analysis comprises comparing the electromagnetic characteristic theoretically predicted for the reservoir based on the approximate geometry of the reservoir and based on the reservoir being a water-bearing reservoir to the electromagnetic characteristic for the reservoir that is determined from the detected electromagnetic wave field response of the reservoir.

2. The method as claimed in claim 1, wherein the field is applied using at least one stationary transmitter located on the earth's surface.

3. The method as claimed in claim 2, wherein the at least one transmitter is located proximate a bed of a body of water.

4. The method as claimed in claim 1, wherein the detection is carried out by at least one stationary receiver located on the earth's surface.

5. The method as claimed in claim 4, wherein the at least one receiver is located proximate a bed of a body of water.

6. The method as claimed in claim 1, wherein the applied time varying electromagnetic field is in the form of a wave.

7. The method as claimed in claim 1, wherein the field is transmitted for a period of time of from 30 seconds to 60 minutes.

8. The method as claimed in claim 1, wherein the field is transmitted for a period of time of from 3 minutes to 30 minutes.

9. The method as claimed in claim 4, in which the receivers are arranged to detect a direct wave and a wave reflected from the reservoir, and the analysis includes extracting phase and amplitude data of the reflected wave from corresponding data from the direct wave.

10. The method as claimed in claim 6, wherein the wavelength of the transmitted wave is given by the formula

$$0.1s \leq l \leq 10s;$$

where l is the wavelength of the transmission through an overburden overlying a reservoir and s is the distance from a seabed to the reservoir.

11. The method as claimed in claim 1, wherein the transmission frequency of the time varying electromagnetic field is from 0.1 Hz to 1 kHz.

12. The method as claimed in claim 11, wherein the transmission frequency of the time varying electromagnetic field is from 1 to 50 Hz.

13. The method as claimed in claim 1, wherein the analysis includes comparing the results of measurements taken with results of a mathematical simulation model based on known properties of the reservoir and conditions of an overburden.

14. The method as claimed in claim 6, including suppressing a direct wave, thereby reducing the required dynamic range of receivers receiving a reflected wave and increasing resolution of the reflected wave.

15. The method of claim 1 including as preliminary steps; performing a seismic survey to determine the geological structure of a region and analysing the survey to reveal the presence of a subterranean reservoir.

16. The method of claim 1 wherein the electromagnetic characteristic theoretically predicted for the reservoir is a member of the group consisting of resistivity and permittivity.

17. The method of claim 1 wherein the geometry of the reservoir includes a depth from a seabed to the reservoir.

18. Apparatus for determining the nature of a subterranean reservoir having a content, the approximate geometry and location of the subterranean reservoir being known, comprising:

means for applying a time varying electromagnetic field to the strata containing the reservoir; means for detecting the electromagnetic wave field response; and

means for analysing the effects on the detected field that have been caused by the reservoir, thereby enabling the content of the reservoir to be determined based on the analysis, wherein the analysis comprises comparing the electromagnetic characteristic theoretically predicted for the reservoir based on the approximate geometry of the reservoir and based on the reservoir being a water-bearing reservoir to the electromagnetic characteristic for the reservoir that is determined from the detected electromagnetic wave field response of the reservoir.

19. Apparatus as claimed in claim 18, wherein the means for applying the field comprises at least one transmitter and the means for detecting the field comprises an array of receivers.

20. Apparatus as claimed in claim 19, in which the transmitter and receivers comprise dipole antennae or coils.

21. Apparatus as claimed in claim 19, wherein a plurality of transmitters are employed.

22. Apparatus as claimed in claim 18, in which the analysing means is arranged to analyse phase and amplitude.

23. The method of claim 18 wherein the electromagnetic characteristic theoretically predicted for the reservoir is predicted for the depth and is a member of the group consisting of resistivity and permittivity.